9-31 C

Dup.

PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

VOL. XXIX FEBRUARY, 1922 NO. 1

Eggs of Three Cercopidae.
G. W. Barber & W. O. Ellis 1

A New Species of New England Coleoptera.
C. A. Frost 4

The Embolemid Genus Pedinomma in North America.
C. T. Brues 6

A New Schendyloid Chilopod From Mexico.
R. V. Chamberlin 9

Parasitic Hymenoptera from the Fiji Islands.
C. T. Brues 10

Evidences of Relationship Indicated by the Venation of the Fore Wings of Certain Insects with Especial Reference to the Hemiptera-Homoptera.
G. C. Crampton 23

The Seal of the Cambridge Entomological Club
A. P. Morse 42

CAMBRIDGE ENTOMOLOGICAL CLUB

OFFICERS FOR 1922

President . . . . . W. M. WHEELER
Vice-President . . . . . L. R. REYNOLDS
Secretary . . . . . J. H. EMERTON
Treasurer . . . . . F. H. WALKER
Executive Commiitee . NATHAN BANKS, W. L. W. FIELD, P. G. BOLSTER

EDITORIAL BOARD OF PSYCHE

EDITOR-IN-CHIEF

C. T. BRUES, HARVARD UNIVERSITY

ASSOCIATE EDITORS

C. W. JOHNSON, Boston Society of Natural History.
NATHAN BANKS, Harvard University.
A. L. MELANDER, Washington State College.
A. P. MORSE, Wellesley College.
J. H. EMERTON, Boston, Mass.
J. G. NEEDHAM, Cornell University.
W. M. WHEELER, Harvard University.

PSYCHE is published bi-monthly, the issues appearing in February, April, June, August, October and December. Subscription price, per year, payable in advance: $2.00 to subscribers in the United States, Canada or Mexico, foreign postage, 15 cents extra. Single copies, 40 cents.

Cheques and remittances should be addressed to Treasurer, Cambridge Entomological Club, Bussey Institution, Forest Hills, Boston 30, Mass.

Orders for back volumes, missing numbers, notices of change of address, etc., should be sent to Cambridge Entomological Club, Bussey Institution, Forest Hills, Boston 30, Mass.

IMPORTANT NOTICE TO CONTRIBUTORS.

Manuscripts intended for publication, books intended for review, and other editorial matter, should be addressed to Professor C. T. Brues, Bussey Institution, Forest Hills, Boston 30, Mass.

Authors contributing articles over 8 printed pages in length will be required to bear a part of the extra, expense for additional pages. This expense will be that of typesetting only, which is about $2.00 per page. The actual cost of preparing cuts for all illustrations must be borne by contributors: the expense for full page plates from line drawings is approximately $5.00 each, and for full age half-tones, $7.50 each; smaller sizes in proportion.

AUTHOR'S SEPARATES.

Reprints of articles may be secured by authors, if they are ordered before, or at the time proofs are received for corrections. The cost of these will be furnished by the Editor on application.

Entered as second-class mail matter at the Post Office at Boston, Mass. Acceptance for mailing at special rate of postage provided in Section 1103, Act of October 3, 1917, authorized on June 29, 1918.

PSYCHE

VOL. XXIX. FEBRUARY 1922 No. 1

EGGS OF THREE CERCOPIDÆ.

By Geo. W. Barber and Wm. O. Ellis.

Bureau of Entomology, U. S. Department of Agriculture.

In Eastern Massachusetts, *Philænus leucophthalmus* Linn, and *Philænus lineatus* Linn which Prof. Herbert Osborn (Bull. 254, Me. Agri. Exp. Sta. 1916) has designated as the Meadow Froghopper and the Grass-feeding Froghopper respectively, are undoubtedly the most numerous species of Spittle insects. *Philaronis bilineata* (Say) is also found, sometimes in large numbers, usually on grasses, near or on the extensive salt marshes of this region.

In August 1921, the writers confined adults of these three species in separate lantern-globe cages in which plants of *Setaria glauca* were growing. This grass was used because it was near at hand—not because these insects had showed any partiality for it as a food plant.

Eggs were easily obtained in this way, and the method of oviposition was found to agree exactly with that observed during 1920 when eggs of *P. leucophthalmus* Linn. were obtained in confinement and found in the field on Tansy, *Tanacetum vulgare*.

Oviposition of these three species is very similar indeed. Individual eggs nearly agree both in shape and in color and are deposited in the same manner. The eggs are laid in single rows, side by side, in numbers of from 2 to 24. Individual eggs are imbedded in, and the entire mass is surrounded with a white, frothy appearing material which is tough and inelastic and securely holds the individual eggs so that they can be dissected from it only with difficulty. This protective material is more plentiful about the edges of the mass and becomes sparse at the top and bottom where the mass lies in close contact with the stem and sheath of the plant.

M4714

The eggs are inserted between the stem and the leaf sheath at a point where the sheath adheres closely to the stem, the mass lying parallel with and very near to the edge of the sheath. It is evident from all the egg masses thus far observed that the female does not thrust her ovipositor thru any portion of the plant tissue,

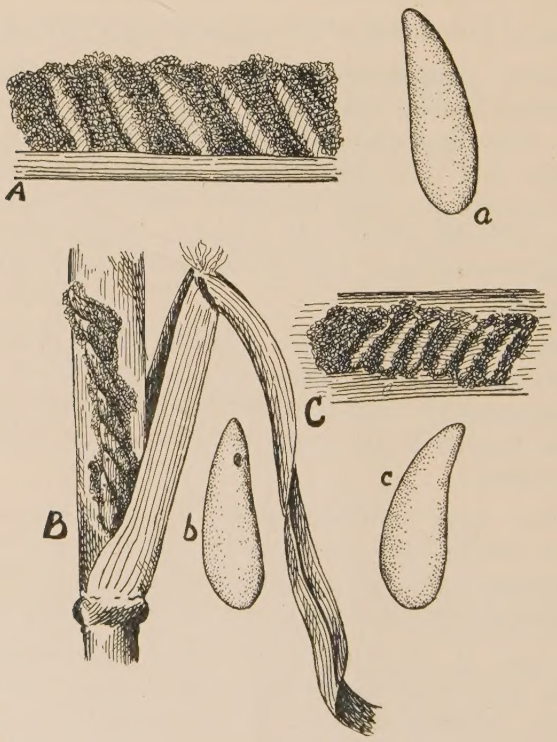


Fig. 1. A, *Philaronia bilineata* (Say), egg mass; a, egg of same; B, *Philaenus lineatus* Linn. eggs in situ; b, egg of same; C, *Philaenus leucophthalmus* Linn. egg mass; c, egg of same.

but merely inserts the eggs between the stalk and leaf sheath. Frequently the masses can be seen thru the leaf sheath, particularly when the latter is dried. Sometimes a portion of the mass can be seen exposed along the edge of the sheath.

Individual eggs are smooth, shining, slightly flattened, more than two times as long as wide, one end tapering, the other bluntly rounding; sides each convexly curved or with one side slightly incurved. They are light yellow in color, usually with a slight lemon tinge.

Prof. Osborn (ibid 1916) described and figured the eggs of *P. leucophthalmus* Linn. dissected from the female adult. Our description nearly coincides with his.

Philœnus lineatus Linn.[1]

Egg; Length. 98 mm; Width .37 mm. Protecting material only moderately abundant to sparse; individual eggs scarcely separated Eggs per mass 2 to 24.

Philœnus leucophthalmus Linn.

Egg: Length 1.03 mm; Width .39 mm. Protecting material abundant; individual eggs slightly separated. Eggs per mass 2 to 18.

Philaronia bilineata (Say.)

Egg: Length 1.22 mm; Width .42 nmm. Protecting material abundant; individual eggs more noticeably separated by protecting material. Eggs per mass 5.

[1]Since this paper has been in the hands of the publisher there has appeared a study of *Philaenus lineatus* Linn., (Philip Garmon, Conn. Agri. Expt. Sta. Bulletin 230, in which the eggs are described.

A NEW SPECIES OF NEW ENGLAND COLEOPTERA.

By C. A. Frost, Framingham, Mass.

Cantharis (*Telephorus*) *andersoni*, sp. nov.

Size and form of *rotundicollis* Say. Color entirely testaceous except for the following black, or at least dark piceous areas: the outer joints of antennæ, a diamond-shaped spot on the vertex a spot between the front coxæ and one on each side of the gular suture, the meso and metasternum, the greater part of the first six ventral segments, the hind tibiæ and generally the middle tibiæ and the distal ends of the hind femora, a dark spot occasionally on the middle femora above at the knees, the scutellum generally dark and sometimes black, the tarsi more or less dark especially beneath. Head sparsely punctured and pubescent, tumid between and in front of the antennæ, with a transverse impression above each antenna, the second joint of which is short and the rest subequal. Thorax orbicular, nearly smooth and sparsely pubescent; front and side margins translucent and reflexed, more deeply concave at the sides before the middle, the tumid cordiform area of the disk abruptly limited by a deep groove in front of the hind margin of the thorax, the median impressed line faintly indicated at the middle becoming deeper and broadly triangularly depressed behind. Elytra more densely pubescent with yellowish hairs, smooth (finely punctured at the insertions of the hairs) at the base, becoming gradually strongly granulato-rugose to the apex. Beneath finely punctured and pubescent, more sparsely so on the abdomen. Anterior claw on all the tarsi with a basal tooth which is more slender and with the inner edge more curved on the hind and middle ones. Length 11 to 13 mm.

The sexual characters are as usual not strongly indicated. The male antennæ are slightly longer, the second joint being shorter in comparison with the third, and the basal tooth of the claw on the anterior tarsi are broader than in the female; the seventh segment of the abdomen is broadly emarginate, exposing an eighth segment, in the male.

There seems to be little variation in the 13 males and 8 females from Belmont, Mass., or in the two males and four females from Mt. Desert Island, Me. One of the females has the elytra distinctly darker and in another the occipital spot is obsolete. The dark portions of the 5th and 6th abdominal segments show a tendency to vanish on the median line behind and almost disappear in some of the males.

This species belongs near *rotundicollis* but can easily be distinguished by the color, orbicular thorax and sculpture of the elytra. Specimens of both these species were sent to Dr. Horn of Berlin, Germany, who writes that they are distinct from known European forms although the present species slightly resembles *obscura* L.

The species was first brought to my attention by a specimen in some material sent me in the summer of 1920 by Mr. C. S Anderson to whom the species is dedicated. On May 28 he took 50 specimens at Belmont, Mass. May 18, 1921, a few specimens were seen and on May 20 he made a special visit there without success. On May 22 he found them present in great numbers on Japanese barberry, and also in lesser numbers on grasses and other plants; 72 were taken, and 50 more on the 25th. The owner of the estate said they had first been noticed in 1918 but in much less numbers. A few scattered specimens were noticed in Arlington in June and July. Mr. G. C. Wheeler took two specimens in Forest Hills on English elms. Mr. C. W. Johnson took one specimen on July 18, 1919 at Jordan's Pond on Mt. Desert Island, Me., and on June 7 and 8, 1921 he found it very common around hedges and on fences at Bar Harbor on the Island.

Like the parallel case of *C. neglectus* Fall (which is, however, much less strikingly differentiated from its congener *carolinus* with which it was undoubtedly confused) we have here a still stranger and more sudden appearance in numbers of an undescribed species of this genus in these comparatively well-collected regions. It would seem to have been extremely rare or local to have escaped the notice of Dr. Harris, Frederick Blanchard

and the many other assiduous collectors who have diligently combed this section of New England.

Paratypes are in the collections of Mr. H. C. Fall, C. S. Anderson, Col. T. L. Casey, U. S. National museum, Boston Soc. Nat. History, Museum of Comparative Zoology at Cambridge, and the National Museum at Ottawa, Canada.

THE EMBOLEMID GENUS PEDINOMMA IN NORTH AMERICA.

By Charles T. Brues.

Bussey Institution, Harvard University.

Several years ago Dr. Joseph Bequaert showed me a strange wingless Hymenopteron that had been collected by Mr. Wm. T. Davis on Staten Island, New York in 1910. Neither of us was able to recognize it at the time and he kindly allowed me to retain the specimen for closer study. During early May of the present year, when collecting insects in the Stony Brook Reservation near Boston, Mass., Professor W. M. Wheeler found a second specimen beneath a stone which I saw at once was exactly similar to the one obtained by Mr. Davis. During the remainder of the afternoon we searched carefully for further specimens in the neighborhood, but were unsuccessful.

The insect proves to be a species of Pedinomma, a genus described nearly a century ago by Westwood[1] and not known outside of Europe till 1912 when Kieffer[2] described as *P. angustipenne* a species obtained by Prof. F. Silvestri at Coipué in Chile.

The North American specimens agree quite closely with Westwood's European species, *Pedinomma rufescens* as nearly as I can ascertain from descriptions which have been given by several writers[3], but it does not seem probable on account of its wingless condition that our American species can be identical with the palæarctic one.

[1]Mag. Nat. Hist., vol. 6, p. 496 (1833).
[2]Bol. Lab. Zool. Gen. Portici, vol. 6, p. 174.
[3]Westwood (loc. cit.), Förster, Keiffer and Marshall.

Pedinomma[1] *nearcticum* sp. nov.

♂ Length 4-4.3 mm. Fulvo-ferruginous; flagellum, palpi, legs beyond femora and the adbominal segments beyond the middle of the second, lighter; first and basal half of second abdominal segments and teeth of mandibles darker, more or less fuscous. Head and thorax, except as noted, subopaque finely, granular. Head seen from above one-half longer than broad, its sides parallel behind the eyes, the centers of which are at the anterior third of the head; narrowed obliquely in front of the eyes so that the short antennal prominence is one-third as wide as the vertex. In profile the head is an almost equilateral triangle gently convex above and below. Eyes ovoid, placed near the top of the head, broadest in front, separated by a little more than their length from the base of the antennæ and as broad as the thickness of the scape. Maxillary palpi short, 3-jointed; first joint very short; second broad, enlarged at apex; third slender, pointed, nearly as long as the second; labial palpi 2-jointed, short. Mandibles broad, with four subequal teeth, clypeus clearly separated, one-third as long as the face, with large lateral foveæ. Antennæ 10-jointed; scape as long as the head, as long as the four following joints; second twice as long as thick and two-thirds as long as the third which is two and one-half times as long as broad; following gradually more attenuate, but not perceptibly shorter; last (the tenth) one-fourth longer than the ninth. Ocelli entirely absent. Thorax three times as long as broad above where it is barely as wide as the head; widened below, especially in front so that the pleuræ are visible from above; dorsal surface almost flat above; pronotum as long as the propodeum, but the mesonotum and scutellum together about half as long as either of the others; prothorax with a distinct constriction near the anterior edge extending from the lateral edge entirely across the middle; anterior to this it is indistinctly transversely aciculate. Mesonotum very small, in front two-thirds as wide as the pronotum, and narrowed behind, with the lateral edge raised and preceded by a

[1]Westwood applied the name Myrmecomorphus to his species, but Förster considered this as a homonym of Dufour's dipterous genus Myrmemorpha since the latter word is incorrectly formed. Later authors have used Förster's name Pedinomma and I have here followed them

groove. Tegulæ large and distinct; wings reduced to small oval bulbs, but little longer than the tegulæ, lying in depressions at the side of the mesonotum and scutellum. The latter small, broader than long with a pair of deep, nearly conflunt foveæ at the base. Propodeum a little longer than wide, sides parallel, apex of dorsal face truncate, apical angles each with a minute tooth; posterior face nearly perpendicular. Meso and metapleuræ and sides of propodeum obliquely rugoso-striate; propodeal spiracle elongate, almost linear. Abdomen not depressed, nearly circular in cross-section, strongly bent downwards at apex, the upper surface smooth, without any constrictions, the tergites extending well down on the sides; first one almost as long as second; third, fourth and fifth each about two-thirds as long, subequal; apical segments short. Anterior femora and tibiæ greatly thickened; middle legs slightly so; hind legs moderately slender. Tarsi, especially the four posterior ones long and slender; inner spur of hind tibia oval, pad-shaped, outer one narrowly spatulate, but not pointed at tip and less than one-third as long as the metatarsus. Claws slender, simple.

Type from Stony-brook Reservation, Boston, Mass., May 8, 1921 (W. M. Wheeler); paratype from Wyandauch, Long Island, N. Y., May 1, 1910 (W. T. Davis)

I have stated that the specimens are males as the antennæ are 10-jointed although I cannot be sure, and Kieffer was also in doubt as to the sex of the Chilian species. Both sexes of the European form are practically apterous, although the Chilian, *P. angustipenne* has very short, strap-shaped wings.

As already noted, *P. nearcticum* is very close to *P. rufescens*, but the comparative lengths of the antennal joints are different. Several European varieties have been based on slighter variations of the same sort, however, and the American form may possibly prove to represent only a variety or subspecies. Pedinomma is not known from Asia, but it is a very rare insect in Europe and may quite possibly range far to the east of its present known habitat.

A NEW SCHENDYLOID CHILOPOD FROM MEXICO.

By Ralph V. Chamberlin,

Museum of Comparative Zoology, Cambridge, Mass.

The type of the interesting new chilopod described below was taken by Dr. Wm. M. Mann several years ago at Guerrero Mill, Hidalgo, Mexico. It represents a new genus related to the North American genera Nyctunguis Chamberlin and Nesonyx Chamberlin in having ventral pore areas in the anterior region and in possessing a well developed claw on each anal leg. It differs from these genera in having only a single coxal pore on each side. In this respect it agrees with the West African Mesoschendyla of Attems, but the latter genus has no claw on the anal legs.

Mexiconyx, Gen. nov.

Claw of the second maxillæ pectinate. Labrum with median arc bearing true teeth which are well chitinized and have distinct roots. Mandible with a single pectinate lamella. Ventral pores present on sternites of the anterior region. A single coxal pore on each side, this simple or homogeneous. Anal legs terminating in a normal claw.

Genotype.—*M. hidalgoensis*, sp. nov.

Mexiconyx hidalgoensis, sp. nov.

Head longer than wide, widest in front of middle; anterior margin convex or very obtusely subangular, the caudal margin straight and the lateral margins convex and converging caudad from in front of middle. Prebasal plate not exposed, the head well overlapping the basal plate, the exposed portion of which is rather short. Claws of prehensors when closed surpassing the head, reaching to the end of the second antennal article or nearly so. Joints of the prehensors unarmed within. Prosternum also unarmed; without chitinous lines. Labrum rather deeply excavated at the middle and bearing in the type twenty-two teeth of which those of the median arc are more strongly chitinized and differentiated; five teeth at the crest of the arc are directed ventrad. Dentate lamella of mandible presenting six or seven

conical and strongly chitinous teeth which do not seem to be segregated in distinct divisions. Ventral pores present in a circular area on sternites of anterior region but absent from middle and posterior regions, last ventral plate wide. Coxal gland one on each side, this homogeneous, and, while large, was evident in the type only after clearing of the specimen. Anal legs long, with well developed claws, with sparse stiff hairs over surface in general and numerous finer and shorter ones on ventral surface of proximal joints in particular, as usual, e. g. in species of Nyctunguis. Palpus of second maxilla rather short and stout; claw short, excavated, pectinate along the edge to and around the end, the setæ long. Number of pairs of legs, in female, fifty-five. Length, about 18 mm.

PARASITIC HYMENOPTERA FROM THE FIJI ISLANDS.[1]

By Charles T. Brues.

Several years ago when Dr. Wm. M. Mann visited the South Seas, he collected extensively in the British Solomons and in Fiji where he obtained a small number of Parasitic Hymenoptera. These he very kindly gave me for study and those from the Solomons have already been dealt with.[2] Meanwhile Turner has published a list and descriptions of some new Hymenoptera from Fiji in which he enumerates 53 species.

Of Mann's material there remains a smaller, but perhaps even more interesting series from Fiji and many of these are treated in the present paper. I have also included one particularly curious genus contained in a small lot of Serphoidea from Fiji sent me by Mr. F. Muir who collected it when he visited these islands in 1905.

As will appear evident from the context, these groups at least, show a strong Australian element in the fauna, but suggest the probable occurrence of a considerable number of peculiar endemic genera.[3]

[1]Contribution from the Entomological Laboratory of the Bussey Institution Harvard University, No. 197.

[2]Bull. Mus. Comp. Zool., vol. 62, No. 3, pp. 97-130, pl. 1 (May 1918).

[3]Turner (Trans. Ent. Soc. London, 1918, p. 334) has expressed a similar opinion, based mainly on the aculeata of these islands.

Family Evaniidæ.

Hemifœnus extraneus Turner.

Trans. Ent. Soc. London, 1918, p. 342 (*Hyptiogaster*).

♂ Length 7-8 mm. Dark reddish brown, varied with lighter brown, the paler markings, not very sharply defined, as follows: head below the antennæ, entire orbits, vertex, neck behind, irregular streaks on mesonotum, margin of propleura, mesopleura except behind, propodeum except for a median dark line, lateral spot at middle of first and at tip of first,of second and of third abdominal segments, posterior margin of following segments, base of antennal scape and four anterior tibiæ; hind legs with the femora and tibiæ lighter on the lateral surfaces. Wings hyaline, stigma and veins piceous. Head distinctly wider than the thorax, one-half broader than thick, occipital margin sharp, but not strongly elevated; ocelli in a triangle, as far from one another as from the eye-margin. Eyes with their facial margins parallel, surface sparsely but distinctly hairy; almost touching the base of the mandibles. Occiput irregularly, transversely aciculate, the striæ oblique to the side of the ocelli and very fine and more or less concentric about the base of the antennæ; clypeus and face below antennæ smooth, except for very delicate dense punctures at the sides just below the antennæ. Mandibles large, the basal and the apical tooth long. Antennæ inserted just above the middle of the eye: scape and first flagellar joint about equal, each two and one half times as long as the pedicel; second and third flagellar joints equal, together barely one-third longer than the first, each nearly twice as long as thick; following gradually decreasing in length, the penultimate but little longer than thick. Head behind the eyes smooth, the foraminal margin higher than on the occiput, transparent. Neck barely as long as the distance from tegula to anterior margin of mesonotum, with a very strong median carina below. Mesonotum with a V-shaped impression formed by the parapsidal furrows which originate on the sides at the anterior third and meet medially behind at the posterior third; between them near the anterior margin are traces of two delicate impressed longitudinal lines; surface coarsely transversely striate,

these striæ curving backwards on the lateral lobes; scutellum flat, the postscutellum concave with raised lateral and posterior margin, almost contiguous with the tubercle upon which the abdomen arises. Thorax in lateral view slightly higher than long, the propodeum almost vertical behind. Propleura smooth except for a few short coarse horizontal striæ centrally, below, and along the posterior margin; mesopleura punctulate, but smooth and polished behind; metapleura smooth and polished; propodeum reticulate, more coarsely so medially in front, with a distinct transverse carina just behind the middle (obliterated in some specimens). Abdomen three times as long as the thorax; petiole smooth, as long as the three following segments together, the spiracle at the middle; second to sixth of about equal length, the whole abdomen formed as in Gasteruption; polished basally and subopaque beyond. Hind coxæ striate above, smooth below; femora slender, the tibiæ constricted at base, but not greatly swollen apically, not broader than the femora; hairy, but without any short stiff spinules; longer tibial spur a little more than half the length of the metatarsus, the latter at least four times as long as thick and as long as the following joints together; claws long, slender, simple. Wings with the basal nervure arising considerably to the base of the stigma; cubitus arising just behind the middle of the basal; first section of radial vein two-fifths as long as the second which is reduced in thickness on its apical half; recurrent nervure entering the first cubital cell just beyond the basal third; anterior discoidal cell more than twice as long as the posterior one which is open behind; nervulus interstitial. Hind wing with three frenulum hooks.

Six males from Fiji (W. M. Mann). One specimen is from Navai and all the others from Nadarivatu. Turner records Cuvu.

Turner (*loc. cit*) has placed this species in Hyptiogaster and compared it with *H. darwinii* Westw. If Kieffer's genus Hemi fœnus is distinct, it seems to me that the Fijian form must be placed there on account of the very short thorax. *H. darwinii* was unknown in nature to both Schletterer and Kieffer, and the latter author (Das Tierreich, Lief. 30, p. 212) refers it to Pseudo-

fœnus, giving a translation of Westwoods original description which did not enable him to place the species generically.

The type and only species so far referred to Hemifœnus is from Australia. No specimens are available for comparison, but from Kieffer's comprehensive description[1] it is evident that the Fijian species differs in several respects from his *H. brevithorax.* The eyes are pubescent, not bare and the posterior femora are but slightly swollen, scarcely "keulenförmig" as in *H. brevithorax.* Unfortunately all the known examples are males and the type species is known in the opposite sex only, which might account for these rather pronounced differences. Turner's type is also a male although both sexes of *darwinii* are known.

Evania impressa Schletterer.

Ann. Hofmus. Wien, vol. 4, p. 153 (1889)

Enderlein, Arch. Naturges. 1901, p. 191.

Bradley, Trans. Amer. Ent. Soc., vol. 34, p. 173 (*Acanthinevania*)

Kieffer, Das Tierreich, Lief. 30, p. 109 (1912).

Turner, Trans. Ent. Soc. London, 1918, p. 342.

Two males and two females from Lasema, Fiji (W. M. Mann). Both females and one male show a distinct, although very short, median keel on the face just below the antennæ and the abdominal petiole in all is distinctly longer than the distance from its base to the base of the propodeum. The Fijian examples therefore approach the Australian *E. angulata* Schlett. which I am inclined to believe is not a distinct species.

Family Braconidæ.

Exobracon nitidulus sp. nov.

♀ Length 7-9 mm.; ovipositor 4-5 mm. Head, prothorax and first segment of abdomen, except tip, pale yellow; thorax bright ferruginous; abdomen, beyond petiole black above, except for a narrow white band just before apex; venter white between the small, white sclerites; sheaths of ovipositor black; antennal

[1]Ann. Soc. Ent. France, vol. 80, p. 182 (1911) and Das Tierreich, Lief, 30, p. 192 (1912).

scape black, flagellum brown; wings very dark brown, yellowish, and with the viens lighter, near their bases; body sparingly clothed with short, sparse yellowish brown hairs. Head but little wider than long, the temples broadly rounded and the occiput weakly excavated; front with a slight impression above the antennæ ocelli small, very close together. Eyes large, distinctly emarginate opposite the base of the antennæ; malar space short, with a weak furrow; mandibles bidentate, black at tips; head smooth, except for some very minute punctures on the face. Scape of antennæ simple, twice as long as thick; first flagellar joint less than twice as long as thick; second and all the following, quadrate or nearly so. Prothorax entirely smooth, above with a sharp transverse groove which extends to the middle of the propleuræ. Mesonontum highly polished, the parapsidal furrows impressed, but not very deep. Propodeum smooth and polished, with a linear groove just below the small, round spiracle. Abdomen smooth and shining, with few minute scattered punctures on the second and following segments. Median area of first segment nearly as broad as long, side pieces with a longitudinal groove, the segment about as long as wide; second segment twice as wide as long, with a large basal median area that is as long as wide and reaches nearly to the posterior margin, just outside it is an oblique furrow, parallel with the lateral margin of the segment and not attaining the posterior margin; third segment a little shorter and considerably wider than the second, anterior corners produced forward; but not separated by a furrow; fourth and fifth segments narrower, but nearly as long as the third; following very short. Hypopygium cultriform, but not exceeding the pygidium. Pleuræ smooth, the metapleura indistinctly punctulate. Sheaths of ovipositor nearly bare. Legs stout, but not thickened; hind coxæ short, flattened and much expanded inwardly at the base. Radial vein arising at the middle of the rather broad stigma, not attaining the wing tip, third section as long as the other two combined; cubitus bent at base, recurrent nervure interstitial with the very oblique first transverse cubitus; second cubital cell scarcely half as high as long above, the sides parallel; nervulus postfurcal,

not oblique; nervellus arising below the middle of the cell; submedian cell in hind wing very short.

♂.Length 7 mm. Similar, but with the middle part of the first abdominal segment longer and blackened on the apical half. Eyes no longer than those of the female.

Type from Lobasa, Fiji; eleven female and one male paratype from Lobasa, Navai and Vunisea, Fiji (W. M. Mann).

I have not been able to compare this with any other species of the genus, but am satisfied that it is properly placed. It differs from Archibracon (*Pseudobracon*) in the basally bent cubitus, shorter, distinctly ovate abdomen and more clearly cubical head. It is evidently a common Fijian species.

Palinzele Gen. nov.

Related to Zele Curtis, but differing in the immargined head, non-convex propodeum, with the abdomen inserted well above the hind coxæ. Malar space as long as the basal width of the mandible; hind coxæ long and slender; nervulus post-furcal; second cubital cell elongate; ovipositor very short; spur of hind tibia half as long as the metatarsus; tarsal claws simple.

Type: *Palinzele oceanica* sp. nov.

This genus is similar to Zele, but differs in the absence of a margin on the head behind and in the higher insertion of the abdomen. The slender hind coxæ as well as the other two characters just mentioned are similar to Macrocentrus and the several genera grouped about it. On account of the very short ovipositor and habitus, however, the type appears to approach Zele and its allies more closely.

Palinzele oceanica sp. nov.

♀. 8-8.5 mm. Pale ferruginous, the face and anterior legs paler yellowish; flagellum of antennæ, ocellar space and sheaths of ovipositor black; hind tibiæ, except knees, and hind tarsi piceous; wings subhyaline, with a brownish tinge, stigma and veins very dark brown. Head more than twice as broad as thick, not margined behind; its surface smooth, except for minute punctures on the face, more conspicuous medially and on the clypeus;

clypeal foveæ deeply impressed, nearly as far from one another as from the eye; face slightly tuberculate above each fovea and clypeus strongly elevated centrally; malar space one-fourth the eye-height, with a distinct furrow; mandibles large, inner tooth well developed; palpi short, third joint of the maxillary ones scarcely two-thirds as long as the first flagellar joint; ocelli well separated, the lateral ones separated by their own length from one another and from the eye margin. Antennæ with about 55 joints, considerably longer than the body; second joint of flagellum practically as long as the first, the following growing very slightly shorter. Mesonotum and scutellum smooth; median lobe highly convex; furrows crenulate, basal scutellar impression cross-striate. Propodeum granulate, finely reticulate apically; the subspiracular carina complete, but the transverse one entirely wanting; spiracle small, oval; upper surface oblique, not convex in profile, the abdomen inserted well above the hind coxæ. Pleuræ sparsely, minutely punctate, the propleura smooth, except at center. Abdomen slightly longer than the head and thorax together, compressed apically; first segment as long as the scutellum and propodeum; four times as long as broad at apex which is twice as wide as the base, spiracles at the basal fourth; entire abdomen smooth, conspicuously yellowish pilose apically. Legs rather long and slender, the hind coxæ about three times as long as broad. Hind tibiæ and tarsi very slender, but the longer apical spur fully half the length of the metatarsus; the tibia distinctly flattened, except on the basal third. Radial cell not attaining the wing tip; first section of radius more than half as long as the second which is less than half as long as the third; first discoidal cell not petiolate; nervulus perpendicular, distinctly postfurcal; recurrent nervure entering half its length before the tip of the first cubital cell; second cubital cell narrowed apically, the second transverse cubitus half as long as the first and three fourths as long as the second section of the radius; nervulus arising at the lower fourth of the discoidal cell; last section of cubitus imperfectly chitinized. Radial cell of hind wing enlarged basally and constricted, but not divided medially.

Type and paratype from Fiji (W. M. Mann); the former from Vunisea and the latter from Levuka.

Aulacocentrum Gen. Nov. (Fig. 1, A, B, C.)

Related to Macrocentrus, but differing especially in the following particulars: mandibles very small and acute, with the apical tooth very small; clypeus highly convex, not distinctly separated from the face; first segment of abdomen somewhat longer than the distance from the tegulæ to the apex of propodeum, six times as long as wide at the apex which is but little wider than the base, its spiracles projecting as tubercles at the basal third; second and third segments equal, together one-third longer than the first and very narrow; radial cell in hind wings divided by constriction, the apical part narrow, the basal broad, with the radial vein thick and heavily chitinized.

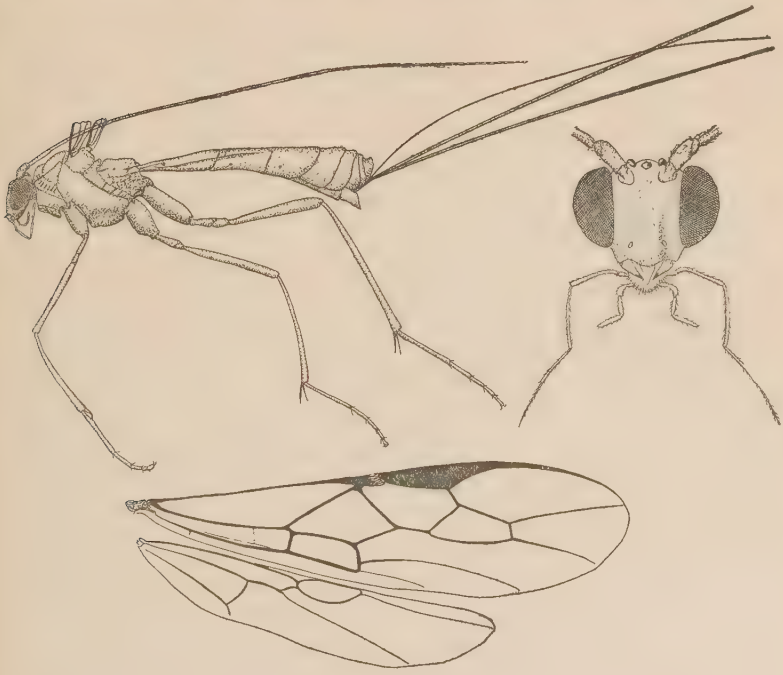


Fig. 1. *Aulacocentrum pedicellatum* sp. nov. ♀ ; profile view of body, front view of head and wings.

Head three times as wide as thick; not margined behind; ocelli very large; maxillary palpi long, five jointed; labial palpi 4-jointed; eyes large and strongly projecting, antennæ thin, longer than the body. Mesonotum strongly trilobed; propodeum and pleuræ finely sculptured; spiracle minute, circular. Legs very slender; ovipositor longer than the body. Recurrent nervure entering the first cubital cell; first discoidal cell barely sessile above; nervulus postfurcal; nervellus issuing at the lower third of the discoidal cell.

Type: *A. pedicellatum* sp. nov.

Aulacocentrum pedicellatum sp. nov.

♀ Length 13 mm.; ovipositor 15 mm. Dull ferruginous; antennæ black, except on scape above; lateral lobes of mesonotum, tegulæ, four anterior legs beyond coxæ and abdomen toward tip, flavous. Wings hyaline at base, the apical half distinctly infuscated; venation piceous, the stigma dark, but with a pale central streak. Ovipositor ferruginous, its sheaths black. Face faintly punctate, shining; malar space one-fifth as long as the eye-height; vertex and head behind smooth. Antennæ with about 55 joints, the first flagellar joint nearly as long as the eye-height, following decreasing in length, those near the middle of the flagellum thrice as long as thick. Mesonotum shining, the furrows deeply crenate, meeting near the middle; lobes smooth and shining. Scutellum highly convex; finely, closely punctate. Propodeum above minutely rugulose-reticulate, irregularly transversely striated behind the spiracle; anteriorly below the spiracle with a longitudinal carina; sides below confluently punctate; margin next to the mesopleura impressed, cross-striated; spical angle at base of the hind coxa produced. Mesopleura with an oblique impression, below sparsely punctate. Propleura smooth, with a median impression. First segment of abdomen transversely aciculate (as in Stephanus); second segment and base of third somewhat irregularly longitudinally aciculate; apical segments faintly punctulate. Tibial spurs of hind leg less than half as long as the first tarsal joint; claws minute, simple. Second section of radius twice as long as the first, third longer than the other two; nervulus received less than

half its length from the base of the first discoidal cell; recurrent nervure entering nearly its own length before the apex of the first cubital cell; second transverse cubitus half as long as the first; basal part of radial cell in hind wing oval, one third as broad as long.

Type from Suene, Fiji (W. M. Mann).

Family Ichneumonidæ

Echthromorpha immaculata Krieger.

Mitt. Zool. Mus. Berlin, vol. 4, p. 331 (1909).

Morley, Revis. Ichneum. British Mus., pt. 2, p. 47 (1913) (*diversor*).

Bridwell, Proc. Hawaiian Ent. Soc., vol. 4, p. 110 (1919).

Turner, Trans. Ent. Soc. London, 1918, p. 344.

There are numerous specimens of both sexes from Vunisea, Labasa, Somo-somo, Wainunu, Vagasau, and Ovalau. Bridwell records Viti Levu from material collected by Muir, and lists *E. diversor* described from the Solomons or New Hebrides as a synonym.

Paniscus fijiensis sp. nov.

♀ Length 14-16 mm. Uniformly pale dull ferruginous, with the head, except ocellar tubercle and posterior margin pale yellowish; antennæ blackened, except at extreme base; wings hyaline, with the stigma ferruginous and the venation piceous. Face very slightly narrowed below; clypeal foveæ contiguous to the eyes; emargination of eyes strong and acute. Ocelli separated by distinctly less than their diameter, the posterior ones touching the eye margin. Apex of mandible long and acute, inner tooth short and blunt. First joint of flagellum fully one-half longer than the second which is barely longer than the third. Thorax more noticeably pubescent than usual, its surface appearing dull and conspicuously silvery; sculpture very delicate, consisting of dense, very minute punctures; on the upper side of the propodeum these merge to form extremely fine transverse aciculations. Transverse carina of propodeum indicated only as a lateral tubercular ridge; subspiracular carina complete,

delicate; profile of propodeum oblique, only slightly curved. Tibiæ and tarsi of all legs spinulose; external hair brush of hind tibiæ distinct, extending from the constriction at basal fourth to the apex. Nervulus postfurcal by two-thirds its own length, strongly arcuate above, but scarcely oblique; second recurrent nervure bifenestrate; apical vein of areolet obsolete below, not produced apically; tip of recurrent nervure distinctly beyond the hayline side of the areolet.

♂ Differs only by having the aciculations of the propodeum more clearly indicated medially, and by the white face and orbits, as well as the larger ocelli. The lower outer side of the areolet is more distinct.

Type, six paratype females and six males from Vunisea, Fiji and one male from Lau, Fiji (W. M. Mann).

This is evidently related to *P. productus* Brullé, with which it shares the externally angulate, although not appendiculate areolet. The propodeal striæ are, however, not "very distinct" as described by Brullé for his species, and the stigma is not red as described by Morley from Tasmanian examples, this island being the type locality for *productus*. From *P. contrarius* Morley, the present form differs entirely in the position of the nervulus, the only character which he gives to separate this Queensland species from *productus*. Turner has recorded the widespread *P. opaculus* (*testaceus*, var.) from Fiji, but the present series do not belong to that species; the propodeum is scarcely curved above, the tibial spinules more sparse and the second flagellar joint longer.

Henicospilus turneri Morley.

Revis. Ichneum., vol. 1, p. 51 (1912).

One female from Vunisea (W. M. Mann).

Henicospilus apicifumatus, Morley.

Entomologist, vol. 48, p. 139 (1915).

One female from Labasa (W. M. Mann).

Family Scelionidæ.

Platyscelio Kieffer.

Ann. Mus. Civ. Genoa, Ser. 3, vol. 2 (42), p. 11 (1905).

This remarkable genus of Scelionidæ, with greatly flattened body was first found in New Guinea from whence Kieffer (*l.c.*, p. 12) described the type, *P. pulchricornis* in 1905. Since then it has been found in Indo-malaya, Australia and Polynesia (Guam). All of the species so far described appear to be very

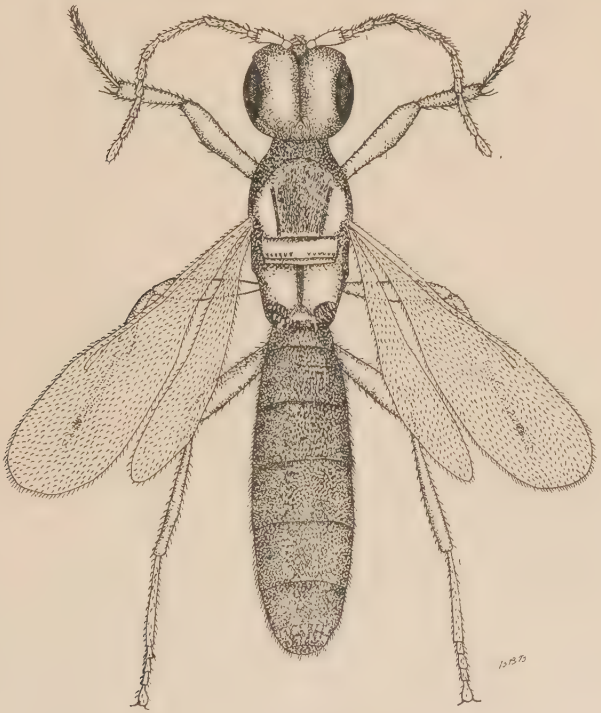


Fig. 2. Platyscelio sp. ♂

closely related, and from the several descriptions I have been unable to distinguish clearly two male specimens from Fiji which quite possibly represent an undescribed species. These were collected on Rewa of the Fiji group by Mr. F. Muir in 1905. As the genus has never been figured, except for a diagram of the

female antenna by Kieffer (*l.c.*). I have taken this opportunity to publish a figure (Fig. 2) of the complete insect which was drawn by my wife several years ago.

As Fiji is so far removed from the localities where the other species have been taken, it would appear probable that the present species is new. From the Australian *P. mirabilis* Dodd (Trans. Roy. Soc. So. Australia, vol. 37, p. 132 (1913) and *ibid.* vol. 39, p. 444 (1905) it differs in having the propodeal groove trongly crenate and also in having the apical abdominal segments entirely punctate. However, my only specimen of the Australian species is a female, and the male may be still more similar. From the type species, *P. pulchricornis* Kieffer (*l.c.*) it differs by the presence of oblique striæ on the propodeum behind and by a longer marginal vein (six times as long as thick) which extends only to the middle of the wing. From *P. abnormis* Crawford (Proc. U. S. Nat. Mus., vol. 38, p. 126 (1910) known from Manila, it differs by lacking distinct punctures in the groove along the anterior orbits and the antennæ are blackened apically. From Fullaway's, *P. wilcoxi* found on Guam, (Proc. Hawaiian Ent. Soc. ,vol. 2, p. 283 (1913) it differs in having the abdomen entirely black and in having the apical antennal joints elongate; it is possible however, that Fullaway may have had a female and not a male as he supposed at the time the description was written; *P. punctatus* Kieffer. (Insecta Rennes, vol. 3, p. 321, (1914) may be the same species.

So far the habits of these strangely flattened insects do not appear to have been observed. Neither have those of the Australian *Platytelenomus* Dodd (Ent. News, vol. 25, p. 126 (1914) which is modified in the same way. Dodd refers to the latter as common in "forest country" and as it is probably an egg parasite, the females may find their hosts beneath bark as appears to be the case with the greatly flattened although much larger Braconids of the genus Platybracon.

EVIDENCES OF RELATIONSHIP INDICATED BY THE VENATION OF THE FORE WINGS OF CERTAIN INSECTS, WITH ESPECIAL REFERENCE TO THE HEMIPTERA-HOMOPTERA.

By G. C. Crampton, Ph. D.

Massachusetts Agricultural College, Amherst, Mass.

In the August issue of Psyche for 1921 (Vol. 28, p. 116) Mr. F. Muir offers a criticism of certain views proposed by me concerning the origin and relationships of the Hemiptera, and since Mr. Muir's criticism is apparently based upon a complete misunderstanding of my contentions concerning the interrelationships of the insectan orders in general, and the Hemiptera and Homoptera in particular, I would take this opportunity of correcting the mistaken impression given by Mr. Muir in his criticism. It is necessary first, however, to clearly understand the interrelationships of the lower forms and allied insects, before taking up the discussion of the phylogenetic development of the Hemiptera and Homoptera, and on this account I would postpone the discussion of Mr. Muir's criticism until the evidence of relationship to be gained from a study of the venation of the fore wings has been presented.

The discussion of the evidences of relationship in the different orders of insects indicated by a study of the venation of the fore wings has been taken up in the present paper because the wing veins are practically the only structural details preserved in a condition suitable for a comparative study in the fossil precursors of living insects, and because the evidence of the wing venation is apparently the only evidence of relationship which recent students of insect phylogeny deem worthy of their consideration! So far as possible, however, I have used the evidence of the wing veins to corroberate the evidences of relationship drawn from the study of numerous other structures of the body as well, thereby obviating the danger of being deceived by convergent development—as might be the case if one were to depend upon the evidence of one set of structures, such as the wing veins, alone.

The anatomy of the body in general in the Plecoptera indicates that they are among the most important of the living forms which have departed but little from the condition typical, in many respects, of the ancestors of the Orthoptera-like insects, and the higher orders. The venation of the fore wings of recent Plecoptera, however, does not furnish a particularly favorable basis of comparison in attempting to determine the paths of development followed in the evolution of the higher orders of insects, while the venation of the Protorthoptera in particular, and in some respects that of the Protoblattids, (Propalæoptera) Hadentomoids, (Proplatyptera) Megasecoptera etc., as well, apparently furnish certain servicable clews for tracing the origin of some of the developmental (evolutionary) tendencies exhibited in the wing venation of certain of the higher orders of insects.

Since the Protorthoptera appear to be as important as any of the fossil forms suggestive of the precursors of the higher insects, it is of some interest to establish as closely as possible the types ancestral to the Protorthoptera. Handlirsch apparently derives the Protorthoptera directly from the Palæodictyoptera (or from the Synarmogoidea, which he derived from the Palæodictyoptera); but a comparison of the wings of such a Protorthopteron as *Spaniodera ambulans*, or even the Protorthopteron shown in Fig. 30, with the Protoblattid shown in Fig. 32, would indicate that the Protoblattids are intermediate between the Protorthoptera and the Palæodictyoptera. In the forewings of the lower Protorthoptera and in certain Protoblattids, the anal veins are numerous, and in the hind wings of certain Protorthoptera there occurs an anal fan very suggestive of that found in many Protoblattids. The character of the cubital vein with its numerous oblique branches (cubital bars) and its rather wide extent in the posterior portion of the fore wing, is strikingly similar in both Protorthoptera and Protoblattids, and the nature and extent of the subcostal bars, or veinlets extending from the subcostal vein to the anterior margin of the wing, are much alike in both groups of insects (Protorthoptera and Protoblattids). When the more primitive

representatives of the Protorthoptera are compared with certain Protoblattids, it may readily be seen that the branches of the median and radial veins are also much the same in both groups of insects, so that the Protoblattid types of wings may be regarded as representing as nearly as any known forms, the precursors of the Protorthopterous types of wings; and the Protoblattids serve to connect the Protorthoptera with the Palæodictyoptera. I do not believe that the Protoblattids themselves are to be derived directly from the Palæodictyoptera, however, but their ancestors were possibly intermediate between the Palæodictyoptera and the ancestors of the Synarmogoids; and the Protorthoptera possibly sprang separately from the same stock, although the Protorthopterous and Protoblattid lines of descent apparently merge as we trace them back to their common stem, so far as the evidence of the wing veins would indicate.

In the reduction of the anals, the shortening of the cubital bars, and the reduction of media to two branches, the fore wing of the Hadentomoid shown in Fig. 10 presents many features suggestive of a rather close relationship with the Protorthoptera, such as the ones shown in Figs. 28 or 26, and the nature of the radius and subcosta is quite similar to that of certain other Protorthoptera. On the whole, however, the type of Hadentomoid wing shown in Fig. 10 might more readily be derived from the type of Protoblattid wing shown in Fig. 12, and it is quite possible that the line of development of the Hadentomoids arose from ancestors anatomically intermediate between the Protoblattids and the Protorthoptera very near the point where these two lines of descent began to diverge from their common Protoblattid-like forebears. The Hadentomoid type of venation is a very important one in suggesting a possible starting point in the the development of the types of venation occuring in the Embiids and their allies, as will be shown later.

The character of the anal, subcostal and cubital veins of the Mixotermitoid fore wing shown in Fig. 25, is very suggestive of both Hadentomoids (Fig. 10) and Protorthoptera (Fig. 28), and the character of the median vein is somewhat suggestive of

that of certain Protorthoptera (Fig. 9), while the branching of the radial vein is somewhat suggestive of the condition occurring in other Protorthoptera—although the nature of the median and radial veins in the Mixotermitoids is much more suggestive of the Palæodictyoptera. The ancestors of the Mixotermitoids were possibly intermediate between those of the Hadentomoids and those of the Protorthoptera, though the Mixotermitoid type apparently harks back to the Palæodictyoptera in many respects.

In the general character of the anals and the cubital veins, and more strikingly in the nature of the branching of the median vein, the fore wing of the Hapalopteroid insect shown in Fig. 6 approaches the Protorthopteron type (Fig. 9) more closely than any other, so far as I am aware, and the precursors of the Hapaloteroids are doubtless to be sought among the Protorthoptera or their forebears. I formerly adopted Handlirsch's suggestion that the Hapalopteroids were very like the ancestors of the Plecoptera; but a closer examination of the venation of the Hapalopteroid wings would not bear out this assumption.

The more primitive types of forewing venation in the Plecoptera, such as that of *Eusthenia* shown in Fig. 13, apparently hark back to a Protoblattid type resembling in some respects the one shown in Fig. 12, in the nature of the cubital and anal veins; and the anal fan in the hind wing of *Eusthenia* is suggestive of the anal fan of the Protoblattid hind wing. On the other hand, I find much in the venation of the Plecoptera which is suggestive of a rather close relationship to the Protorthoptera, and an even closer relationship to the Hadentomoids, particularly in the nature of the branching of media and radius in the fore wing, as may be seen by comparing Fig. 11 with Fig. 10. Furthermore, if we compare the fore wing of the Plecopteron shown in Fig. 11 with the fore wing of the Embiid shown in Fig. 8, the branching of cubitus, media and radius is strikingly similar, and the evidence of the venation is therefore in harmony with that drawn from the study of other structures of the body indicating a close relationship between the Embiids and the Plecoptera—and if the Embiids are to be derived from ancestors resembling the Haden-

tomoids and Protorthoptera in many respects, their near relatives, the Plecoptera should also be derived from ancestors resembling the Hadentomoids and Protorthoptera in many respects. It is quite possible that the line of development of the Plecoptera branched off from the common Protoblattid- Protorthopteron stem very near the point of origin of the Hadentomoid line of descent, or paralleled these lines very closely and the Plecoptera thus inherited characters found in all three of these groups (Protoblattids, Protorthoptera and Hadentomoids) from the common ancestors which combined all of their common characters in themselves.

As was mentioned above, the Embiid types of fore wings (Fig. 8 and 7) could be readily derived from precursors resembling the Hadentomoids (Fig. 10); but the Embiid types likewise approach very closely to the Protorthopteron types of venation, as one may see by comparing the anal, cubital, and median veins of the Embiid shown in Fig. 8, with these veins in the Protorthoptera shown in Figs. 26 and 28. The second and third branches of radius have begun to coalesce in the Protorthopteron shown in Fig. 26, thus indicating a tendency toward the further coalescence of these veins which has reached completion in the insect shown in Fig. 8; and in the Protorthopteron shown in Fig. 4, the second and third branches of radius coalesce and the fourth and fifth also unite, as is the case with the Embiid shown in Fig. 7. Furthermore, the tendency for all of the branches of media to coalesce exhibited by the Embiid shown in Fig. 7, also occurs in certain Protorthoptera, such, for example, as the one shown in Fig. 30, in which the media consists of but a single branch. From the foregoing facts, it is evident that the tendencies exhibited by the veins of the Embiids could be traced back to Protorthopteron predecessors quite readily. On the other hand, the character of the anals, cubitus, media, radius and subcosta of the Embiids shown in Figs. 8 and 7 is strikingly similar to the branching of these veins in the Hadentomoid insect shown in Fig. 10, and I am convinced that the ancestors of the Embiids must have resembled both the Hadentomoids and the Protorthoptera in many respects. The general anatomy of the

Psocids such as *Embidopsocus*, for example, suggests a very close relationship between the Psocids and Embiids, and since the Psocids were apparently derived from Protorthoptera-like ancestors (as will be presently discussed) it is to be expected that their near relatives, the Embiids, would also be derived from Protorthoptera-like ancestors, so that in indicating an ancestry for the Embiids anatomically intermediate between the Hadentomoids and Protorthoptera, the evidence of the wing venation is quite in harmony with that from other sources as well.

The venation of the Psocid wing shown in Fig. 1 is so similar to that of the Zorapteron shown in Fig. 3, that both were evidently derived from the same source, and what applies to one applies to the other as well. The Psocid and Zorapteron wings shown in Figs. 3 and 1 could readily be derived from the Embiid type of fore wing shown in Fig 7 (as is indicated in the hypothetical intermediate condition shown in Fig. 5)* in the following way. The second branch of cubitus of Fig. 7 might become more vertical, while vein M, which arises from M+Cu and coalesces for a short distance with Rs. in Fig. 7, might unite with Rs further from the base of the wing thus lengthening that portion of M which extends between M+Cu and Rs, as in Fig. 3. R2+3 of the radial sector, Rs, bends upward toward R_1 in Fig. 7, and if R4+5 were to unite with it to form a single branched Rs bending forward to meet R_1, the condition exhibited by Rs in Fig. 3 would be produced. A deposition of chitin and pigment in the space between Sc and R_1 (as indicated in Fig. 5) would produce a pterostigma such as the one labeled "ps" in Figs. 1 and 3. Judging from the same developmental tendencies found in the Psocids, Zoraptera, and Embiids, it would appear that all three were derived from a common ancestral source, and many of the genes, determinants, or factors occurring in this common source were inherited by the three derived groups, although they were naturally slightly modified by other factors in the derived groups, as would be expected. As is pointed out in the next paragraph, the ancestors of the Psocids were apparently very similar to the Protorthoptera, and since the Psocids, Zoraptera

*The figure in the left hand column between Figs. 3 and 7 is Fig 5. The label was lost from this figure, having been pasted on too insecurely.

and Embiids apparenty sprang from the same source, it is very probable that their common ancestors were very like the Protorthoptera in many respects.

That the fore wing of a Psocid could be readily derived from a Protorthopteron prototype may be seen by comparing the fore wing of the Psocid shown in Fig. 2 with that of the Protorthopteron shown in Fig. 4, since the venation of the two wings is strikingly similar, and the Protorthopteron type is evidently the more primitive one, since it is one of an older and lower group, and the branching of the veins in general begins nearer the base of the wing—which is usually a more primitive character than for the branches to come off nearer the apex, since the latter usually indicates a degree of coalescence, and hence a specialization, in the veins. The three anal veins are much alike in Figs. 2 and 4, and the forking of the cubitus in the Protorthopteron shown in Fig. 4 (or better still in the Protorthopteron shown in Fig. 26) is strikingly like that of the Psocid shown in Fig. 2. The three branches of media, and the two branches of Rs are also strikingly similar in the insects shown in Figs. 4 and 2, and the nature of the first branch of radius and the subcostal vein is much the same in both. The Psocids and Protorthoptera thus apparently have many developmental tendencies in common, and probably inherited them from a common ancestry which was very like certain Protorthoptera in may respects, and as was mentioned above, the ancestors of the Zoraptera and Embiids probably also resembled the Protorthoptera in many respects. As will be shown in the next paragrpah, the Psocids and Hemiptera-Homoptera have so much in common, that they also in all probability were derived from the same type of ancestors which must likewise have resembled the Protorthoptera in many respects, although the ancestors of the Homoptera in all probability resembled the Protoblattids as well, and the "roots" of the Homopteron stem apparently strike somewhat more deeply down into the Palæodictyopterous types.

The peculiar bulging antefrontal region of the head incorrectly called the "clypeus" in Cicadid Homoptera and Psocids, the peculiar lengthening of the segments of the antennæ, which, so

far as I am aware, occurs exactly in that fashion only in the Homoptera and Psocids, the nature of the thoracic terga and wing bases, the nature of the tarsal segmentation, and other regions of the leg, the nature of the abdominal segments in general, the segments of certain males and the ovipositors of certain females in particular, and many other features too numerous to mention at this point, all clearly indicate so close a relationship between the Psocids and Homoptera, that it would be stretching the laws of probability and chance far beyond the breaking point to claim that the marked similarity in all of these structures from all parts of the body, and extending through a wide-ranging series of forms, is merely the result of "convergence," and it would be very interesting to learn from those who continually cry "convergence" whenever similarities are pointed out between the Psocids and Homoptera, just how "convergence" could be brought about in so wide a range of forms and in such a multitude of details from all parts of the body! That the many similarities in structures from other parts of the body extend to the venation of the wings as well, in the Psocids and Homoptera, is shown in the series of insects figured in Figs. 17 to 24, which includes some of the most primitive, and the most highly specialized, as well as the intermediate types of venation, in the two groups of insects. Thus, the peculiar "broken" character of the venation of the apical portion of the Psocid wing shown in Fig. 24 is paralleled by the wing of the Homopteron shown in Fig. 23, although the fore wing of the Homopteron *Cercopis* sp., figured by Handlirsch, 1909, would have been better for a comparison with the Psocid shown in Fig. 24, than is the case with the Homopteron shown in Fig. 23. The broader more primitively veined Psocid wing shown in Fig. 22 is paralleled by that of the Homopteron shown in Fig. 21, and the venation in the two is quite similar. Turning next to the intermediate type of venation shown in Fig. 18, it is quite evident that the Psocid shown in Fig. 18 is approached by the Homopteron shown in Fig. 20, especially in the character of the anals, and the branching of cubitus and media, which is strikingly similar in the two groups of insects, and there is evidently a tendency toward the formation of a pterostigma

between the first branch of radius and the anterior margin of the wing, as well as a tendency for Rs to turn forward toward the anterior margin of the wing. In order to make the series include as wide a range of types as possible, I have included some of the most specialized types as well, and, as one may see by comparing Figs. 17 and 19, in which radius and media are practically the only veins retained in a well develped condition, there is a marked parallelism in the more highly specialized members of the two groups, as well as in the intermediate and more primitive representatives of the Psocids and Homotera. This parallelism in a wide range of wing types, as well as in a multitude of structures from all parts of the body, can be explained only as the result of the operation of the same developmental tendencies (i.e. the expression of the presence of the same genes, determinants or factors—albeit these are modified to some extent in the derived groups by the influence of other factors) inherited from a common ancestry.

From the foregoing facts, I would conclude that the Psocids and Hemiptera-Homoptera were descended from very similar ancestors, and since the Psocids were apparently descended from ancestors closely resembling the Protorthoptera in many respects, it naturally follows that the ancestors of the Homoptera must also have resembled the Protorthoptera in many respects. The fact that the saltatorial Orthoptera, which are the modern representatives of the Protorthoptera, have likewise retained many features suggestive of affinities with the Hemiptera-Homoptera is also in harmony with such a derivation of the Homoptera; but there are other factors involved, which further complicate the question of the origin of the Homoptera. The primitive type of venation exhibited by the fore wing of the Homopteron *Hotinus* sp., figured by Handlirsch, 1909, appears to be of a lower type than that of most Protorthopterous fore wings, and suggests affinities with the Neuroptera and Protoblattids. The venation of the Homopteron *Ormenis* is also very suggestive of that of certain Neuroptera such as *Psychopsis*, particularly in the peculiar arrangement of certain small cross veins which unite end-to-end to form a paramarginal line extend-

ing parallel to the margin (but at some distance from it) in the fore wing. The nature of the thoracic sclerites of the Homoptera would lend further weight to the view that the ancestors of the Homoptera were very like those of the Neuroptera, and the fact that many insects descended from the common Neuropteroid stem, such as the Mecoptera (and even the Siphonaptera) exhibit very similar tendencies in the specialization of their mouth-parts (which tend to lose the ligula, while the labial palpi become approximated and unite to some extent, and the maxillæ become much elongate and somewhat stilet-like) would suggest that they and the Homoptera inherited these tendencies from a common ancestry. Furthermore, the fore wings of certain primitive Trichoptera and Mecoptera, which were derived from a common Neuropteroid stem, show undoubted affinities with certain types of Homopterous fore wings, and lend further weight to the supposition that the ancestors of the Homoptera resembled those of the Neuropteroid insects in many respects. Thus, the Trichopterous fore wing shown in Fig. 27 is remarkably like that of the Homopteron shown in Fig. 29, especially in the character of the anal and cubital veins; and the other veins of the wing are also of much the same type in the two wings under consideration. All of these facts, which indicate that the ancestors of the Homoptera and Neuroptera were very closely related, are in harmony with the fact that the Homoptera and Psocids are also very closely related, since the Psocids themselves are clearly related to the Neuroptera, and their line of development apparently merges with that of the Neuroptera near its point of origin, thereby involving the line of develpoment of the Homoptera with that of the Neuroptera through their mutual relationship to the Psocids, as well as through the more direct affinities of the Homoptera themselves with the Neuropteroid insects. I have therefore maintained that the ancestors of the Homoptera were intermediate between those of the Psocids and those of the Neuroptera, and the present study of the fore wing venation would uphold the correctness of this view.

If one compares the wing of a Neuropteron such as the one shown in Fig. 34, with the wing of a Protoblattid such as the one

shown in Fig. 32, there is a pronounced similarity between the two types of wings, especially in the nature of the anal veins, and the cubital and subcostal bars. The character of the median vein is also quite similar in both, although the radial veins are not quite so much alike in the two insects. While there is considerable evidence pointing to the Protoblattids as the probable precursors of certain primitive types of Neuropterous wings, some of the Neuropterous types, on the other hand, have retained certain Palæodictyopterous characters which suggest that they hark back to Palæodictyoptera-like forebears. Handlirsch suggests that the Megasecoptera represent the precursors of the Neuroptera, and certain tendencies in the Megasecopterous wing, such as the tendency toward the anastomosis of the radial sector, media, and cubitus, are certainly very suggestive of similar tendencies in the wings of certain Neuroptera. I would not derive the Neuroptera directly from the Megasecoptera, however, as Handlirsch does, since the Neuropterous wings evidently partake of certain characters in common with the Protoblattids in addition to preserving certain features suggestive of the Palæodictyoptera, so that all of these lines of descent apparently either branched off near the base of the common Protorthopteron-Protoblattid stem, or they parallel each other remarkably closely as we trace them all back to their common Palæodictyoptera-like ancestors.

In the nature of the branching of its anal, cubital, and median veins, *Eugereon*, the supposed ancestor of the Hemiptera and Homoptera (Fig. 31) is apparently a Palæodictyopteroid insect resembling, in some respects, the Palæodictyopteron shown in Fig. 33, while in many features the wing of *Eugereon* is very suggestive of the Megasecopteron type. The primitive type of Homopterous wing shown in Fig. 29 is not very similar to *Eugereon's* wing (Fig. 31), and it would be very difficult to derive the primitive type of venation exhibited by the Homopteron *Hotinus* (which is more like a Neuropterous or Protoblattid type) mentioned above, from a wing such as that of *Eugereon*, since the latter appears to be somewhat more specialized than the venation of *Hotinus*. Taking all of the facts into con-

sideration, it would appear to be more probable that instead of arising from *Eugereon*, the line of descent of the Homoptera arose at the base of a common Protorthopteron-Protoblattid stem, or it parallels the common Protorthopteron- Protoblattid stem very closely as we trace them all back to their common ancestors resembling the Palæodictyoptera, which gave rise to such forms as *Eugereon*, and the Megasecoptera.

In the nature of their mouthparts, their widely separated coxæ and broad sterna, and to some extent in the nature of their ovipositors, etc., the Thysanoptera exhibit many features suggestive of a relationship with the Hemiptera; but the venation of the Thysanoptera is too highly specialized to be of much value in determining the origin and affinities of the Hemiptera, although they do offer certain points of contact with both Hemiptera and Psocids, which would be expected if the Psocids and Hemiptera were related both to each other and to the Thysanoptera. The character of the radial and median veins which extend parallel to each other down the center of the wing of the Psocid shown in Fig. 17 is very suggestive of the character of the radius and media which also extend parallel to each other down the middle of the Thysanopteron wing shown in Fig. 15. The radial and median veins of the Orthopteron shown in Fig. 16, however, likewise extend parallel to each other down the center of the wing, and the character of the cubital vein, and the branches of the radial vein of the Orthopteron shown in Fig. 16 are even more like those of the primitive Thysanopteron shown in Fig. 14. These similarities may be taken to indicate that the Orthoptera, Psocids and Thysanoptera were all descended from Protorthoptera-like precursors, and inherited much the same tendencies from this common ancestry, although these tendencies (or the genes, determinants, or what not, which they express) were slightly modified by different factors in the different lines of development derived from this common source If the Hemiptera-Homóptera were also descended from ancestors similar to the Protorthoptera in many respects, this might also account for certain similarities between the Hemiptera-Homoptera and certain Orthoptera, which are too evident to be entirely passed over.

The facts brought out in the foregoing discussion would indicate that the ancestors of the Hemiptera-Homoptera arose from forms anatomically intermediate between the ancestors of the Psocids and those of the Neuropteroid insects. In other words, the ancestors of the Hemiptera-Homoptera were apparently anatomically intermediate between the insects forming the common Protorthopteron-Protoblattid stem and the Megasecoptera, and their line of descent either merged with that of the Protorthopteron-Protoblattid stem and the Megasecoptera, or paralleled them extremely closely, as they all approached their common origin in an ancestral group resembling the Palæodictyoptera in many respects. The interrelationships of the primitive forms grouped about the base of the lines of descent of the Homoptera and the Neuropteroid insects is shown in the appended diagram (Text figure 1) in which the lines of descent in

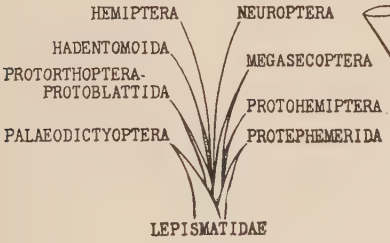


Fig. 1

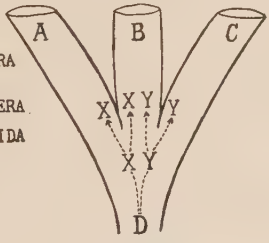


Fig. 2

question are represented as though branching off in different directions, since this method apparently is more in accord with the facts of a complicated interrelationship between these groups of insects than is the case when one attempts to represent their lines of descent by means of a dichotymously branching tree.

Having repeatedly stated that no living forms can be derived from other living forms (see footnote to page 148 of the American Naturalist, Vol. LIII, 1919, etc.) and since this fact is so widely accepted as to be more of the nature of a truism, it hardly seemed necessary to waste energy and space by repeating this utterly obvious fact every time a living insect was compared with a

another living insect belonging to a more primitive group; and on this account it is amazing that Mr. Muir should accuse me of deriving *living* Psyllids from *living* Psocids especially since I definitely state in a paragraph *which he quotes*, that the lines of descent of the Homoptera, Thysanoptera, Psocids Hymenoptera and related forms "apparently arose from ancestors intermediate between the Zoraptera (with the Isoptera) on the one side, and the Coleoptera (with the Dermaptera) on the other." In other words, the ancestors of the Homoptera, Psocida, Hymenoptera, etc., were very similar to the Protorthopteron-like and Protoblattid-like ancestors of the Zoraptera and Coleoptera. This is surely a very different matter from claiming that the Homoptera were descended from living Psocids! I have always been careful to state that the Psocids were in many respects *very like* the ancestors of the Homoptera, just as the chimpanzees are in many respects *very like* the ancestors of man (i.e. the *Pithecanthropus*-like forms), yet such a statement by no means implies that men were descended from living chimpanzees—and the same principle holds true in the comparison of the Homoptera with the Psocids, abeit the groups compared in the latter case belong to different orders instead of belonging to different families of the same order, and the differences are naturally somewhat greater in the one instance than in the other. The idea which I intended to convey is that the Psocids and Homoptera are very closely related (i.e. they have both inherited many tendencies in common which cause their lines of development to parallel each other quite closely) and since the Psocids have evidently departed less than the Homoptera have from the common ancestral types, the ancestral features which they have preserved in a less modified condition, enable us to form some conception of the character of these features in the ancestors of the Homoptera.

Starting with the false assumption that I would derive living Homoptera from living Psocids (an obvious impossibility), Mr. Muir proceeds to a second equally false assumption that I would derive all Homoptera from living Psocids by way of the highly specialized recent family Psyllidæ, simply because I

chanced to use a fore wing of an insect belonging to the genus *Psylla* to illustrate the operation of the same developmental tendencies in the evolution of the wing veins throughout the orders Homoptera and Psocida. The wing type exhibited by *Psylla*, however, is but one of a wide-ranging series of forms (a few of which are shown in Figs. 17 to 24), extending from the lower Psocids and Homoptera to the higher specialized members of the two groups, in which the developmental tendencies operative in directing the evolution of the various types of venation in the Psocid wings are closely paralleled throughout the series by similar developmental tendencies operating in the evolution of the various types of Homopterous wings. In other words, the same genes, determinants or factors were in many cases inherited in both groups from a common ancestry, although they were naturally modified somewhat by different factors in the two distinct orders of insects. This again is a very different matter from claiming that all Homoptera were descended from the highly specialized recent Homopterous family Psyllidæ, and I am at a loss to understand how Mr. Muir could have so completely misconstrued my meaning in this matter.

As a final and culminating false assumption, Mr. Muir implies that I "believe that new orders arise as hybrids from the crossing of individuals belonging to different orders" of insects! The fact that every student of evolution knows full well that the offspring of crosses between different species are generally sterile, and those between different genera are almost invariably so (save in the plant kingdom) should have deterred Mr. Muir from making this curious mistake. However, lest others be misled by Mr. Muir's implication, I would endeavor to indicate graphically by means the diagram shown in Text figure 2, how a third order of insects may partake of characters present in two other orders, without being the result of the crossing of members of the other two orders possessing characters in common with it. I have drawn a similar diagram, and explained it, in an article published in the Fiftieth Annual Report of the Ent. Society of Ontario for 1919; and in order to use the same concrete examples, let us suppose by way of illustration that "A" in Text figure 2

represents the line of development of the higher Crustacea (Isopods, etc.), while "B" represents the line of development of the lower Insecta, and "C" represents the line of development of the "Myriopoda", all of which were derived from a common ancestral group "D", some of whose members contained the factor or group of factors "x", which produces a flat head with mandibles extending up the sides of the head to a point behind the eyes (as the insect *Lepisma*, and the isopod *Asellus*) while others of the ancestral group contained the factor "y," which produces a pyriform head with cryptognathous (endognathous) mouthparts (as in the insect *Campodea* and the "myriopod" *Scolopendrella*). It should be quite evident from the diagram in Text figure 2 that certain insects in "B" could inherit the characters "x" (flat head with huge mandibles) from the "side" of, or in common with, certain higher Crustacea in "A", having inherited these tendencies or factors from the common group "D", which gave rise to both "A" and "B", while certain other insects in "B" could inherit the characters "y" (pyriform head with cryptognathous mouthparts) from the "side" of, or in common with certain Symphyla ("myriopods") in "C", having inherited these tendencies from the common ancestral group "D", which gave rise to both "B" and "C", without postulating that members of "A" and "C" must have interbred to produce these characters in "B". In order to apply the same principle to the orders of insects, let us suppose that "A" represents the line of development of the Psocids, "B" that of the Hymenoptera, and "C" that of the Coleoptera, all of which were descended from ancestors resembling the Protorthoptera in many respects, which may be represented by the ancestral group "D". If "x" represents the factor or factors producing colonial tendencies, while "y" represents the factors producing styli-bearing ovipositors, for example, it should be readily apparent from the diagram, that some members of both Psocids ("A") and Hymenoptera ("B") could inherit tendencies toward "social" life (represented by "x") from a common source in "D", while some members of both Hymenoptera ("B") and Coleoptera ("C") could inherit their tendencies toward the development of styli-bearing ovipostors (represented by "y")

from a common source in "D", without postulating that Coleoptera with styli-bearing ovipositors mated with "socially" inclined Psocids to produce Hymenoptera possessed of these qualities, and it is difficult to understand how Mr. Muir could have arrived at such an obvious "*reductio ad absurdum*" in this matter.

From the foregoing discussion, it is evident that it would be impossible to accurately represent the lines of development of the various insectan orders by means of a dichotomously branching tree, since such an arrangement ignores the evident interrelationships between *several* orders of insects which apparently have sprung from a single ancestral group, and I know of no developmental law necessitating that all evolution in living things shall follow a dichotomously branching path. In fact, the known evidence would seem to indicate that such a method is extremely rare among insects, and it is better to make a theory to fit the facts, than to adhere to some hypothesis which is not in accord with most of the facts which one encounters in his observations. I would therefore prefer to represent the orders comprising the lines of descent of the three sections of winged insects by means of cone-like figures in which the closely interrelated orders converge to a common point of origin in each section. Of these three Pterygotan sections, the higher insects or Neuropteradelphia include the Neuropteroid super-order (Neuroptera, Hymenoptera, Mecoptera, etc.) and the Psocoid superorder (Psocids, Zoraptera, Homoptera, etc.); while the intermediate insects or Orthopteradelphia include the Orthopteroid superorder (Orthoptera, Phasmids, etc.) the Blattoid superorder (Blattids, Isoptera, Mantids, etc.) and the Plecopteroid superorder (Plecoptera, Embiids,, etc.); and the lower insects or Plectopteradelphia include the Palæodictyoptera, Odonata, Ephemerida, etc. The final assignment of certain aberrant orders of obscure affinities has not been definitely determined, but in the main, the venation of the fore wings is in agreement with the grouping of insects into superorders given on page 114 of Vol. 53 of the Canadian Entomologist for 1921.

Abbreviations.

The Arabic subscripts indicate the branches of the veins in question, and a plus sign denotes a coalescence of veins. A=Anal veins; at=alatenaculum; ax=axillary or second anal vein; Cu=cubital veins; M=median veins; pt=pterostigma; R=radial veins; Rs=radial sector; Sc=subcostal vein.

Explanation of Plates I, II, and III.

All figures are of right fore wings. The primitive reticulation (alarete or archidictyon) is partially or wholly omitted in some cases as is also true of many of the cross veins.

Fig. 1.—Psocid *Archipsocus recens*, from Crampton, 1921, after Enderlein, 1903.

Fig. 2.—Psocid *Amphientomum paradoxum*, redrawn from Tillyard, 1918.

Fig. 3.—Zorapteron *Zorotypus snyderi*, from Crampton, 1921.

Fig. 4.—Protorthopteron *Lepium elongatum*, redrawn from Handlirsch, 1920.

Fig. 5.—Hypothetical stage intermediate between Fig. 7 and Fig. 3.*

Fig. 6.—Hapalopteroid *Hapaloptera gracilis*, redrawn from Handlirsch, 1920.

Fig. 7.—Embiid *Oligotoma saundersi*, from Crampton, 1921, after Wood-Mason, 1883.

Fig. 8.—Embiid *Donaconethis abyssinica* redrawn from Comstock, 1918 after Enderlein, 1912.

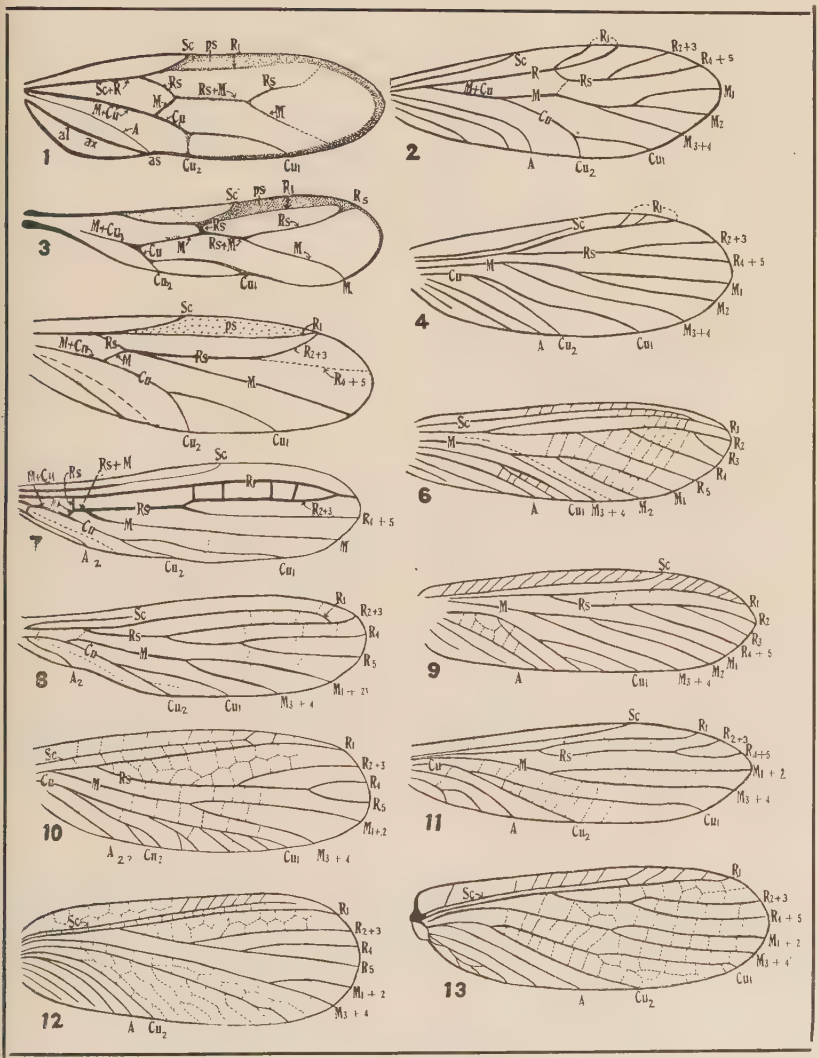
Fig. 9.—Protorthopteron *Liomopterum ornatum*, redrawn from Handlirsch, 1920.

Fig. 10.—Hadentomoid *Hadentomum americanum*, from Crampton, 1921, after Handlirsch, 1906.

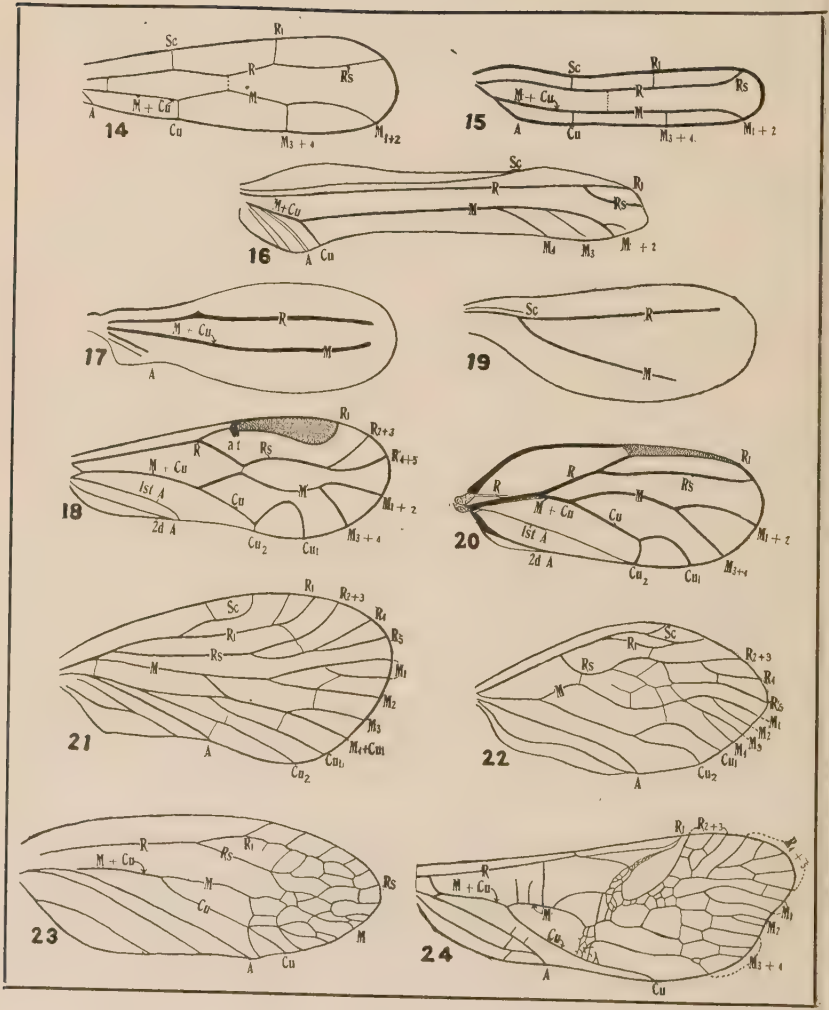
Fig. 11.—Plecopteron *Zelandobius confusus*, redrawn from Tillyard, 1921.

Fig. 12.—Protoblattid *Asyncritus reticulatus*, redrawn from Handlirsch, 1920.

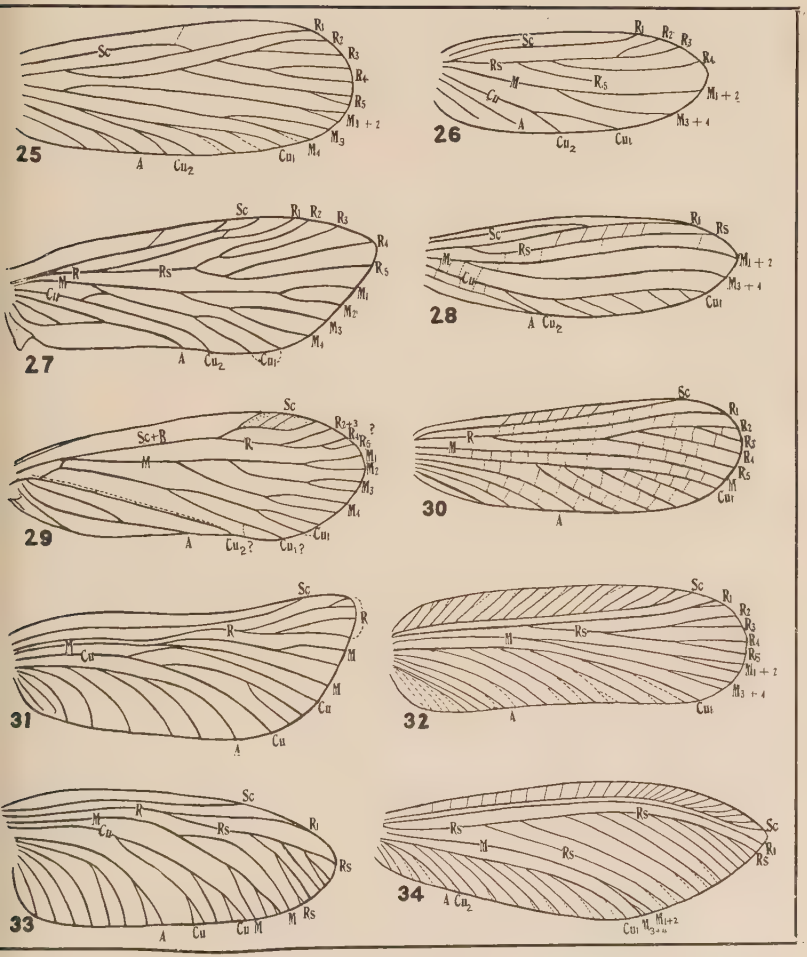
Fig. 13.—Plecopteron *Eusthenia spectabilis*, redrawn from Comstock, 1918.



CRAMPTON—WINGS OF HEMIPTERA-HOMOPTERA



CRAMPTON—WINGS OF HEMIPTERA-HOMOPTERA



CRAMPTON—WINGS OF HEMIPTERA-HOMOPTERA

Fig. 14.—Thysanopteron Palæothrips fossilis, from Crampton, 1921, after Scudder, 1890.

Fig. 15.—Thysanopteron *Aelothrips nasturii*, from Crampton, 1921, after Jones, 1912.**

Fig. 16.—Orthopteron *Dioconema ornata*, redrawn from Handlirsch, 1909.

Fig. 17.—Psocid *Embidotroctes paradoxus* from Crampton, 1921 after Enderlein.

Fig. 18.—Psocid *Hemicaecilius bogotanus* from Crampton, 1921, after Enderlein, 1903.

Fig. 19. —Coccid *Pseudococcus citri*, redrawn from Patch, 1909.

Fig. 20.—Psyllid *Psylla* sp., from Crampton, 1921.

Fig. 21.—Fulgorid *Bothriocera prosignoretti*, redrawn from Metcalf, 1913.

Fig. 22.—Psocid *Calopsocus infelix*, redrawn from Enderlein, 1903.

Fig. 23.—Cercopid *Monecphora bicincta*, redrawn from Metcalf, 1917.

Fig. 24.—Psocid *Neurosema apicalis*, redrawn from Enderlein, 1903.

Fig. 25.—Mixotermitoid *Mixotermes lugauensis*, redrawn from Handlirsch, 1920.

Fig. 26.—Protorthopteron *Delopterum latum*, redrawn from Handlirsch, 1920.

Fig. 27.—Trichopteron Rhyacophila redrawn from Betten, 1913, and Tillyard, 1919.

Fig. 28.—Protorthopteron *Probnis speciosa*, redrawn from Handlirsch, 1920.

Fig. 29.—Homopteron *Dictyophora europæa*, redrawn from Handlirsch, 1909.

Fig. 30.—Protorthopteron *Gyrophlebia longicollis*, redrawn from Handlirsch, 1920.

Fig. 31.—Protohemipteron *Eugereon bœckingi*, redrawn from Handlirrsch, 1920.

Fig. 32.—Protoblattid *Protophasma dumasi*, redrawn from Handlirsch, 1920.

Fig. 33.—Palæodictyopteron *Homoioptera woodwardi*, redrawn from Handlirsch, 1920.

Fig. 34.—Neuropteron *Nymphites braueri*, redrawn from Handlirsch, 1920.

*The label was accidentally scraped off from this figure, which is the third from the top in the right hand column of figures.

**The basal portion of this figure was not inked in, (through an oversight) and consequently does not appear in the plate.

THE SEAL OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

By A. P. Morse, Wellesley, Mass.

[The following note concerning the seal recently adopted by the Club has been supplied by A. P. Morse to whom we are indebted, not only for the design, but also for its artistic execution in the final form which appears on the cover of the present issue of Psyche. Editor]

The Cambridge Entomological Club has always recognized New England as its special and appropriate tho not exclusive field of activity. It is, therefore, fitting that a typically New England insect, the Semidea butterfly, whose habitat is the alpine zone of the Presidential Range of the White Mountains of New Hampshire, should be chosen for representation on its Club Seal.

The insect is here shown perched characteristically on the dark gray, deeply weather-bitten rock-fragments of its mountain home, whose tints and texture its own so closely resemble, that when lying on its side with wings closed to escape the wind it becomes almost invisible. Beyond it at the right is suggested the sedgy slope of "Semidea plateau" (so christened by Scudder) with its rock-rivulets in whose crannies the butterfly often seeks shelter from the furious blasts which sweep over the summits even in midsummer. Beyond, from the depths of the Great Gulf, rise the slopes of the northern peaks, Mts. Jefferson, Adams, and Madison, with Mt. Washington suggested at the left. Over all float the summer clouds which often shroud the summit of Washington for days at a time even when the other peaks are free.

Ward's Natural Science Establishment

84-102 College Ave., Rochester, N. Y.

Best equipped establishment in the United States for furnishing Entomological Supplies and Specimens

Special Attention is called to our

American Entomological Insect Pins.
Hand-made Schmitt and other Insect Boxes.
Cabinets and Exhibition Cases of the finest workmanship.
Life Histories of Insects of Economic Importance, in Riker Mounts, Pasteboard and Wooden Exhibiton Cases, and Preparations in Alcohol.
Type, Mimicry, and Protective Coloration collections.
Collections of Household, Garden, Orchard, Forest and Shade Tree Pests.
Fine Specimens representing Sexual and Seasonal Dimorphism, and Warning Colors.
Our Stock of Exotic Insects is unsurpassed, shipments from our Collectors abroad arriving nearly every week.

The following lists are sent free on application:

116. Biological material for dissection.
125. Life histories of economic insects.
128. List of living pupae.
129. Exotic Lepidoptera.
130. North American Lepidoptera.
131. Exotic Coleoptera.
132. North American Coleoptera.
143. Type, Mimicry, etc., collections.
145. List of Pest Collections.
147. List of Butterflies for trays and decorative work.
C-30. Catalogue of Entomological supplies.

Amer. Ent. Co. price list of Lepidoptera. 80 pages. Price 25 cents. Free to our customers.

New Illustrated Catalogue of Insects ready for distribution.

WARD'S NATURAL SCIENCE ESTABLISHMENT

HANDBOOK OF MEDICAL ENTOMOLOGY

WILLIAM. A. RILEY, Ph. D., Professor of Insect Morphology and Parasitology, Cornell University, and O. A. JOHANNSEN, Ph. D., Professor of Biology, Cornell University.

A concise account of poisonous, parasitic and disease-carrying insects and their allies, including descriptions and illustrations of the principal species, with keys for their determination, and methods of control. Bound in library buckrum, medium 8vo. 348 pages. Price, $2.00 net.

A MANUAL FOR THE STUDY OF INSECTS

JOHN HENRY COMSTOCK, Professor of Entomology, Emeritus, Cornell University.

This handbook is designed to meet the needs of teachers in the public schools and of students in high schools and colleges. The book is so written that any intelligent teacher can find out for himself the more important facts of insect life. Includes tables for identifying any family of insects of North America. The leading school and college text. 700 pages. 800 figures. Price, $4.25 net.

OPTIC PROJECTION

SIMON HENRY GAGE, Professor of Histology and Embryology, Emeritus, Cornell University, and HENRY PHELPS GAGE, Ph. D., Cornell University.

This is a very comprehensive work, dealing fundamentally and practically with the Magic Lantern, the Projection Microscope, the Reflecting Lantern, and the Moving Picture Machine. 730 pages. Over 400 figures. Postpaid, $5.

THE MICROSCOPE

(13th Revised Edition Ready)

SIMON HENRY GAGE, Professor of Histology and Embryology, Emeritus, Cornell University.

An authoritative, up-to-date guide for everyone who uses the microscope and for every beginner who wishes to use the microscope intelligently and effectively. Should be in every school and college laboratory. 472 pages. 265 figures. Postpaid, $3.00.

THE LIFE OF INLAND WATERS

A Text-Book of Fresh Water Biology.

JAMES G. NEEDHAM, Pd, D., Professor of Limnology and General Biology in Cornell University, and JOHN T. LLOYD, A. B., Assistant in Limnology in Cornell University.

This book is a broad presentation of the field of fresh-water biology, primarily in its scientific aspects, also in relation to commercial, civic, aesthetic and public health interests of man. There is no book in the English language covering the field. Copiously illustrated with photographs from nature. 438 pages. 244 figures. Price, $3.00.

THE WINGS OF INSECTS

JOHN HENRY COMSTOCK. Professor of Entomology, Emeritus, Cornell University.

This volume is an exposition of the uniform terminology of the wing-veins of insects. Royal octavo. 430 pages. Illustrated. Price, $3.75 net.

SEND FOR ILLUSTRATED CIRCULARS

For Sale at all Bookdealers or Sent Direct from

THE COMSTOCK PUBLISHING COMPANY

ITHACA, NEW YORK, U. S. A.

500 Pin Labels all alike, 50 Cents.

1000 Pin-Labels all alike, 80 Cents.

Smallest Type. Pure White Ledger Paper. Not over 4 Lines nor 30 Characters (13 to a line) Additional Characters, 2 cents each, in total and per line, per 500. Trimmed.

Prices subject to change without notice.

C. V. BLACKBURN, 30 South St., STONEHAM 80, MASS., U. S. A.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 p. m. at the Bussey Institution, Forest Hills, Boston. The Bussey Institution is one block from the Forest Hills station of both the elevated street cars and the N. Y., N. H. & H. R. R. Entomologists visiting Boston are cordially invited to attend.

WANTED:—Small, bright colored butterflies. Will pay cash for them in quantities. We desire Lycaenas, Small Coppers and any other bright colored small flies for use in butterfly work.

THE CASINO STUDIO
SALEM, MASS.

FOR SALE:—Tropical African (Uganda, Kenia Colony) Butterflies and Moths, etc. etc., in great variety and beauty. Special Bargain lot of 200 Specimens (50 species) at 25 Dollars Post Free . Remittance with order.

R. A. DUMMER,
Care S. A. Museum,
Cape Town.